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13. ABSTRACT  <p>Describes a method for evaluation of bakery equipment operational and performance characteristics. Identifies supporting tests, facilities, and equipment required. Provides procedures for preformed polyurethane board, mechanical flour sifter, and dough mixing machine performance tests. Applicable to flour sifters, dough mixers, dough troughs, dividing machines, molding machines, mixing and make-up outfits, proofing cabinets, ovens, and accessory sets.</p>			

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U. S. ARMY TEST AND EVALUATION COMMAND  
SYSTEM ENGINEERING TEST OPERATIONS PROCEDURES

AMSTE-RP-702-109

Test Operations Procedure 10-2-011

30 December 1971

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BAKERY EQUIPMENT

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SECTION I  
GENERAL

1. Purpose and Scope. This TOP describes test procedures for evaluating the operational and performance characteristics of bakery equipment. Equipment covered includes: flour sifters, dough mixers, dough troughs, dividing machines, molding machines, mixing and make-up outfits, proofing cabinets, ovens and accessory sets. From the tests listed in Section II, the test director can select those that will satisfy the requirements for the particular test item and the particular test type (i.e., engineering test, initial production test, etc.). This document provides for simulated environmental testing but does not include service testing or environmental testing at climatic test sites.

2. Background. To produce bread and other bakery products for the field Army, the baker must not only be skilled in his trade and have good ingredients to work with, but he must also have a modern, well-designed, efficient, easy-to-operate bakery plant in which to prepare his dough and bake his bread and pastry. A field bakery may be staffed by a detachment, a section, or a platoon. It may be either a mobile bakery (trailer mounted equipment) or a portable bakery (usually limited to detachment size) used principally to increase the capability of an element of a mobile field bakery. Field bakery elements are located in functionalized companies such as Headquarters and Headquarters Company, Supply and Service Battalion, Direct Support and Field Service General

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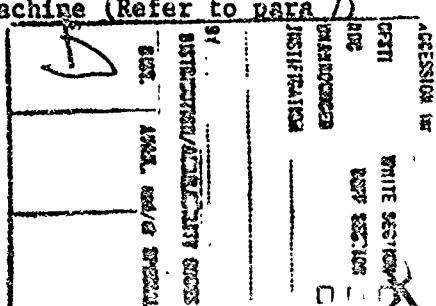
Support Company, Forward. To keep pace with the highly mobile army of today, a field bakery must also have high mobility. While the major components of a bakery plant (i.e., flour sifter, dough mixing machine, dough troughs, dividers, moulders, proofing cabinets, ovens and bread racks) together with over a hundred other smaller components and accessories may be designed for efficient transport in general purpose vehicles, a much more efficient scheme is to build the mixing machine together with the divider and moulder into a trailer mounted unit and the oven into another such unit. To further increase the efficiency, reliability and ease of operation, internal combustion engine drives may be replaced with electric motors supported by a portable or trailer mounted power generator.

3. Equipment and Facilities. In addition to the equipment and facilities defined in the documents listed in Section II, a supply of ingredients for straight dough garrison sheet bread and a bakery accessory set are required to perform the procedures defined by paragraphs 6 and 7.

## SECTION II TEST PROCEDURES

4. Supporting Tests. Common Engineering MIPs/TOPs, Military Standards, the tests defined in Section III, and other published documents to be considered in formulating a test plan are as follows:

TEST SUBJECT TITLE	PUBLICATION NO.
a. Pre-operational Inspection	10-3-500
(1) Operator Training & Familiarization	10-2-501
(2) Photographic Coverage	7-3-519
b. Physical Characteristics	10-2-500
(1) Cellular Hard Board	ASTM
(a) Water Absorption	D-1056-68
(b) Density (pounds/cu ft)	D-1565-70
(c) Compressive strength (psi)	D-1621-64
(2) Preformed Polyurethane Board Density (Refer to para 5)	
c. Safety	10-2-508
d. Performance Tests	
(1) Mechanical Flour Sifter (Refer to para 6)	
(2) Dough Mixing Machine (Refer to para 7)	
(3) Dough Troughs	MIL-D-13053D Para 4.5



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	<u>TEST SUBJECT TITLE</u>	<u>PUBLICATION NO.</u>
(4)	Dough Dividing Machines	MIL-D-2471D
(5)	Dough Molding Machine	Para 4.5
(6)	Dough Mixing and Make-Up Outfit	MIL-D-2477C
(7)	Dough Proofing Cabinet	Para 4.5
	(a) Insulation	MIL-D-43490A
	(b) Temperature and humidity	Para 4.4
(8)	Bakery Oven	MIL-C-40100B
	(a) Trailer mounted	Para 4.3.1.1
	(b) Portable	Para 4.4.1
	Burner Unit	MIL-B-12570C
	(c) Non-Portable	MIL-O-43085A
(9)	Bakery Accessory Set	MIL-B-0040098D
		MIL-O-43633
		Para 4.5
		MIL-B-43322
		Para 2.1
e.	Environmental Testing	MIL-STD-810B
(1)	Temperature	Method 501
(2)	Sunshine	4-2-826
(3)	Rain	2-2-815
(4)	Humidity	4-2-820
(5)	Fungus	4-2-818
(6)	Salt Fog	MIL-STD-810B
		Method 509
(7)	Dust Test	Method 510
(8)	Vibration	4-2-804
(9)	Rough Handling	4-2-602
(10)	Electromagnetic Interference Characteristics	MIL-STD-461A
		Notice 4
		MIL-STD-462
		Notice 3
		Method RE05
f.	Transportability	
(1)	Road, Rail, Marine	10-2-503
(2)	Air	7-2-515
g.	Human Factors Evaluation	10-2-505
	Noise	HEL-STD
		-S-1-63B
h.	Reliability	MIL-STD-781B
		Para 5

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<u>TEST SUBJECT TITLE</u>	<u>PUBLICATION NO.</u>
i. Durability	10-2-502
j. Maintenance Evaluation	10-2-507
k. Value Analysis	USAMC SUPPL 1 to AR 11-26

**SECTION III  
SUPPLEMENTARY INSTRUCTIONS**

**5. Preformed Polyurethane Board.**

a. Objective. To determine the density of preformed polyurethane board.

b. Method. Each of three random samples of any convenient size is weighed to the nearest tenth of a pound and its dimensions accurately determined.

c. Data Required.

(1) Weight of each sample.

(2) Dimensions of each sample.

d. Analytical Plan. The density in pounds per cubic foot is calculated for each sample. The results are averaged and compared to the density of the insulation required by the MN to determine conformance to specifications.

**6. Mechanical Flour Sifter.**

a. Objective. To determine the ability of the flour sifter to aerate the flour and remove any extraneous material that may be present.

b. Method. The sifter hopper is filled with contaminated flour and after operation, the sifted flour is examined by experienced master bakers to evaluate contamination removal and aeration provided by the sifter.

c. Data Required. Nomenclature of the test item and written evaluations prepared by each master baker.

d. Analytical Plan. Summarize and analyze the evaluations of each baker and compare with the requirements of the MN to determine conformance to specifications.

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7. Dough Mixing Machine.

a. Objective. To determine the operational and functional performance of a dough mixing machine.

b. Method. The test item is operated, without load, for a period of one hour. During this time the agitator is activated and deactivated, the bowl tilted and returned to the upright position and operation of all controls checked. Ingredients, prepared in accordance with TM 10-410 (appendix), are then loaded into the mixer in the prescribed order. The mixer is operated to mix and develop the dough. An experienced master baker determines when the dough is ready for proofing.

c. Data Required.

- (1) Nomenclature of the test item.
- (2) Time to mix and develop the dough.
- (3) Written comments of the master baker in regard to gluten development, elasticity and smoothness of mix.

d. Analytical Plan. Summarize and analyze the written comments of the master baker in regard to gluten development, elasticity and smoothness of the mixed dough and compare with the requirements of the MN to determine conformance to specifications.

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APPENDIX  
REFERENCES

1. AR 70-38, "Research, Development, Test, and Evaluation of Materiel for Extreme Climatic Conditions."
2. USAMC Supplement 1 to AR 11-26, "Value Engineering."
3. HEL-STD S-1-63B, "Maximum Noise Level for Army Materiel Command Equipment."
4. MIL-STD-461A, "Electromagnetic Interference Characteristics, Requirements for Equipment", including notices 1 thru 4.
5. MIL-STD-462, "Electromagnetic Interference Characteristics, Measurement of", including notices 1 thru 3.
6. MIL-STD-781B, "Reliability Tests: Exponential Distribution", including change 1.
7. MIL-STD-810B, "Environmental Test Methods", including notices 1 thru 4.
8. MIL-D-2471D, "Dough Dividing Machines, Automatic, Pocket."
9. MIL-D-2477C, "Dough Molding Machines, Loaf."
10. MIL-B-12570C, "Bakery Oven, Trailer Mounted, M-533."
11. MIL-D-13053D, "Dough Troughs."
12. MIL-B-0040093D, "Burner Unit, Gasoline, Field Range Outfit, M2."
13. MIL-C-40100B, "Cabinet, Dough Proofing, Portable, Insulated, 12-pan Capacity."
14. MIL-O-43085A, "Oven, Baking and Roasting, Deck, Gasoline, 3-Compartment."
15. MIL-B-43322, "Bakery Plant, Field, Portable, consisting of 170 Components."
16. MIL-D-43490A, "Dough Mixing and Make-Up Outfit, Trailer Mounted, M-534."
17. MIL-B-43633, "Oven, Baking and Roasting, Deck, Convection, Electric."

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18. TM 10-410, "Bread Baking."
19. American Society for Testing and Materials (ASTM).  
D-1056-68 "Sponge and Expanded Cellular Rubber Products,  
Spec. for", D-1565-70 "Flexible Foams made from Polymers or Co-  
polymers of Vinyl Chloride, Specs and Tests for", D-1621-64  
"Compressive Strength of Rigid Cellular Plastics, Tests for."